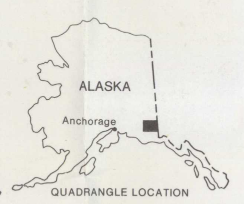
MISCELLANEOUS FIELD STUDIES MAP MF-773-K
FOLIO OF THE McCARTHY QUADRANGLE, ALASKA

Base from U.S. Geological Survey, 1965
Geology generalized by MacKevett, 1976

SCALE 1:250000

CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL
1960 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 28°30' TO 29° EAST



QUADRANGLE LOCATION

Background information for this folio is published as U.S. Geological Survey Circular 739, available free of charge from the U.S. Geological Survey, Reston, Va. 22092.

Table showing linear correlation coefficients between logarithmic values of the concentration of selected elements versus silver, McCarthy quadrangle, Alaska. [Leaders(---)indicate insufficient data.]

Analytical method	Six-step semiquantitative spectrographic analyses																							Atomic absorption and colorimetric 1/					
Element	Fe	Mg	Ca	Ti	Mn	Ag	As	B	Ba	Be	Bi	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sb	Sc	Sr	V	Y	Zn	Zr	Au	Cu	Pb	Zn	Hg	As
Correlation Coefficient(X100)	-4	-20	3	-29	-17		8	-14	-15	58	11	6	-6	46	52	0	52	-6	20	--	-2	-28	-16	-14	7	-35	-2	53	15	-15	25	43
Number of pairs	157	165	151	161	162		35	109	129	17	16	125	130	126	11	58	33	144	83	--	117	119	156	115	21	133	51	20	19	35	16	32

1/ Au, Cu, Pb and Zn by atomic absorption analysis
Hg by flameless atomic absorption analysis
As by colorimetric analysis

DISTRIBUTION AND ABUNDANCE OF SILVER IN BEDROCK, MINERALIZED, VEIN AND ALTERED ROCK SAMPLES, McCARTHY QUADRANGLE, ALASKA

By

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1976

DISCUSSION

A geochemical survey was conducted in the McCarthy quadrangle Alaska, to identify areas containing anomalous concentrations of various metallic and nonmetallic elements. This study incorporates the results of analyses for silver from 827 rock samples collected in the quadrangle and analyzed by the U.S. Geological Survey between 1961 and 1976 using semiquantitative emission spectrophotometry. The samples include both unaltered and hydrothermally altered rocks. The hydrothermally altered rock consists of ore grade material, gossans, fault gouge, vein materials, silica-rich boxworks, veins adjacent to faults, and fracture surfaces showing evidence of mineralization. Therefore, the analytical data set may be considered representative of most rock types known to occur in the study area.

The accompanying map shows the distribution and relative abundance of silver in rocks collected. Geochemical analyses have been grouped and represented by symbols on a base map, which includes topography and generalized geology. The range of analytical values and the symbol that represents it are shown on the histogram. Graphical representation of analytical values on the map permits easy observation of any large variation resulting from separate or duplicate samples collected at the same or nearby localities. All samples were crushed and ground to pass through a 180 micron opening sieve before being analyzed.

The chemical analyses of unaltered and unmineralized bedrock samples are considered to represent background concentrations for the various rock units in the McCarthy quadrangle. These analyses were merged with those from samples representative of hydrothermally altered, mineralized, and (or) biased rock types, such as ore grade material. Thus the geochemical distribution of silver analyses may help to locate potential occurrences of concealed mineral deposits, particularly large buried deposits such as porphyry copper or molybdenum.

The arithmetic and geometric mean values of silver in rocks from the McCarthy quadrangle are 30 and 3.6 ppm, respectively. Based on an evaluation of the statistical data given in the accompanying histogram, silver values ranging from N(0.3) to 0.5 ppm are classified as background values. Those values between 0.7 and 5 ppm are classified as threshold to weakly anomalous, and values greater than 5 ppm silver are considered to be significantly anomalous.

Most of the silver detected in rocks collected in the McCarthy quadrangle occurs in veins or is associated with Kennecott-type deposits. The amygdaloidal basalt flows of the Middle and (or) Upper Triassic Nikolai Greenstone do not seem to be directly related to the silver mineralization. This lack of association is evidenced by the absence of statistically significant positive correlation coefficients occurring between silver, and component elements characteristic of the Nikolai Greenstone such as Fe, Mg, Ca, Ti, Mn, Ba, Co, Cr, Cu, Ni, Sr and V. Only four elements, copper, arsenic, beryllium, and niobium, show significant positive correlation with silver. The association of silver with copper and arsenic is probably related to Kennecott-type deposits and to the tetrahedrite series of minerals occurring in veins. The association of silver with beryllium and niobium is less easily understood, but may be related to the presence of hydrothermal sulfide veins in granitic pegtites.

Because erratic, biased, and in many cases widely separated sample localities were used in this project, undue emphasis may be placed on anomalous silver values occurring in only one or two samples in a given area. In all cases, geochemical interpretation has been made utilizing associated elements in combination with geological, structural, and geophysical data. More detailed geological, analytical, and statistical data for geochemical studies of specific areas in the McCarthy quadrangle can be found in reports by MacKevett and Smith (1968), Winkler and MacKevett (1970), Knaebel (1970), and Winkler, MacKevett, and Smith (1971).

In addition to being a commodity of considerable economic value, silver may be an important pathfinder element that can be used in search for porphyry-type deposits and it is closely related to Kennecott-type copper deposits. Silver often forms halos around zoned porphyry copper deposits. The distributions of silver, molybdenum, gold, and arsenic in rocks, together with the distributions of copper, gold, lead, arsenic, and mercury in stream sediments and glacial debris, may reveal zoning patterns that are related to undiscovered mineral deposits. Preliminary study of the geographic distribution of silver anomalies suggests that most of the silver may be related to areas of potential Kennecott-type copper deposits and to mineralization in the Jurassic(?) and Cretaceous(?) Valdez Group.

Relatively few rock samples have been collected in the area of the McCarthy quadrangle south of the Chitina River and analyzed for silver. Of these samples, one containing anomalous concentrations of silver is from the Golconda Creek area (T. 10 S., R. 11 E.) in the vicinity of the Yellowband and other gold mines and one is from quartz veins cutting rocks of the Valdez Group. Anomalous concentrations of silver in association with anomalous values of gold and arsenic, together with moderately anomalous values of lead and mercury in samples of rock and stream sediments further support the gold potential of this general region. Another silver anomaly occurs at the O'Hara prospect (T. 6 S., R. 9 E.), in veins cutting Permian marble.

Several strong positive silver anomalies were detected in rocks collected from the vicinity of Bonanza Ridge and Porphyry Mountain (T. 5 S., R. 14 E.). These anomalies are probably related to disseminated vein material in the Nikolai Greenstone and the presence of Kennecott-type copper deposits in the area. Anomalous concentrations of molybdenum, arsenic, and gold were also detected in rock samples from the same general locality, with the silver appearing to be peripheral to the gold and molybdenum. Stream sediments collected in the general vicinity contain anomalous concentrations of copper, arsenic, and mercury. In addition, an aeromagnetic survey suggests the presence of positive anomalies (Case and MacKevett, 1976). While the area is not presently known to contain economic mineralization, the potential for porphyry copper amd molybdenum deposits should be considered.

Several strong silver anomalies were detected in rock samples collected adjacent to the Totschunda fault system (T. 3 S., R. 21 E.). However, very few samples have been analyzed from this and the White River area to the northeast, and no conclusions can be drawn from the available data. More detailed sampling is required.

South of the University Peak (T. 6 S., R. 20 E.), several silver anomalies were detected in rock samples. Although some of these silver anomalies are related to vein occurrences, and one sample is from the Harrais prospect (T. 10 S., R. 21 E.), most are probably related to a monzonitic-granitic complex of Pennsylvanian age that intrudes rocks of the Devonian(?) Kaskawulsh Group and the metamorphosed Pennsylvanian and Permian Skolai Group. Outcrops covering several square kilometers show evidence of strong hydrothermal alteration and positive aeromagnetic anomalies occur locally (Case and MacKevett, 1976). Anomalous amounts of copper, gold, arsenic, mercury, and lead were detected in samples of stream sediments and rock collected in the same area. The intrusive complex also contains several molybdenum anomalies and two small tin anomalies. The presence of anomalies of all these elements suggests that this area might contain undiscovered porphyry-type copper and molybdenum deposits related to the intrusive complex.

A few silver anomalies were detected in rocks from an area intruded by Tertiary granodiorite and tonalite in the vicinity of The TWA Harpies (T. 6 S., R. 19 E.). A series of anomalous concentrations of silver in rock samples from the vicinity of TWA Harpies Glacier valley (T. 5 S., R. 19 E.), may also reflect mineralization related to the exposed Tertiary granodiorite and tonalite that intrudes the Nikolai Greenstone. Zones of intense hydrothermal alteration are visible in outcrops. The intrusive may be inferred to extend northwest under the central part of the University Range. This inference is also supported by aeromagnetic data (Case and MacKevett, 1976). Anomalous concentrations of copper, arsenic, mercury, silver, and molybdenum are also present in samples of rocks and stream sediments collected in the same general area. This area may contain porphyry-type copper or molybdenum deposits, however the possibility of contamination by metals from the Nikolai Greenstone cannot be discounted.

Highly anomalous silver values were detected in rocks from the Dan Creek, Nikolai Butte, Williams Peak, Pyramid Peak, Andrus Peak, and Mount Holmes area (T. 6 S., R. 16 E.), and in the upper reaches of Canyon Creek, all located in the south-central part of the quadrangle. The anomalies are considered to be extremely significant. An intrusion of Tertiary granodiorite and tonalite, which forms small outcropping plutons, is inferred to underlie much of the area. These intrusives are probably related to the Tertiary intrusive complex exposed in the University Range (T. 5 S., R. 18 E.) to the northeast. Anomalous concentrations of copper, gold, arsenic, mercury, antimony, lead, and molybdenum detected in samples of rock and stream sediment suggest that relatively intense mineralization probably occurs in this area. Strong positive magnetic anomalies are present (Case and MacKevett, 1976) and hydrothermally altered rocks are visible in outcrops. The area has been extensively placer mined for gold and is known to contain veins of gold-arsenic-antimony, and gold-copper-molybdenum. These element associations strongly suggest the possibility for concealed porphyry-type copper, molybdenum, or other types of deposits.

Very strong silver anomalies were detected in samples of rock collected from the general area of the Kuskulana River south of Skyscraper Peak (T. 2 S., R. 9 E.). The anomalies may be related to veins of sulfides in the Nikolai Greenstone. However, the close proximity of monzodiorite, granodiorite, and tonalite intrusives of the Jurassic Chitina Valley batholith suggest that the mineralized rocks may be related to the intrusives in the area (Moffit and Mertie, 1923). The silver anomalies are associated with copper, arsenic, gold, and molybdenum anomalies.

Anomalous amounts of silver were detected in rock samples collected from the vicinity of the Kluvesna and Kotsina River valleys southwest of Granite Peak (T. 1 S., R. 9 E.). Anomalous concentrations of molybdenum, gold, copper, arsenic, and mercury were also detected in some samples of stream sediment and rock from the same general area. The Jurassic Chitina Valley batholith of monzodiorite, granodiorite, and tonalite underlies much of Granite Peak where it intrudes the Nikolai Greenstone. Positive aeromagnetic highs occur locally (Case and MacKevett, 1976), and strong hydrothermal alteration is visible in outcrops. Some mineralization may be related to the occurrence of veined sulfide ore in the Nikolai Greenstone. However, the area may have good potential for porphyry-type copper and possibly molybdenum deposits.

Silver anomalies detected in rock samples collected south of the Kuskulana River (T. 3 S., R. 9 E.) suggest the possibility of mineralization associated with a skarn environment. Anomalous concentrations of gold, copper, arsenic, and molybdenum were also detected in other samples of rock and stream sediments collected in this area.

An anomalous amount of silver, detected in a rock sample from the west side of the Crystalline Hills (T. 4-5 S., R. 10 E.), appears related to mineralization associated with Pennsylvanian gabbroic intrusives. These intrusives crop out in the Crystalline Hills and also in the adjacent hills to the north. Gold and copper anomalies, together with associated peripheral mercury and arsenic anomalies detected in samples of stream sediment from the area, suggest a potential for concealed mineralization and the area contains a strong positive magnetic anomaly (Case and MacKevett, 1976).

A complete set of coordinates for sample sites, as well as statistical and analytical data, obtained 1974-1976 for silver in rocks collected in the McCarthy quadrangle is available, together with details of sample collection, preparation, analysis, data storage and retrieval, in U.S. Geological Survey Open-File Report 76-824 (O'Leary and others, 1976) and on a computer tape (VanTrump and others, 1977).

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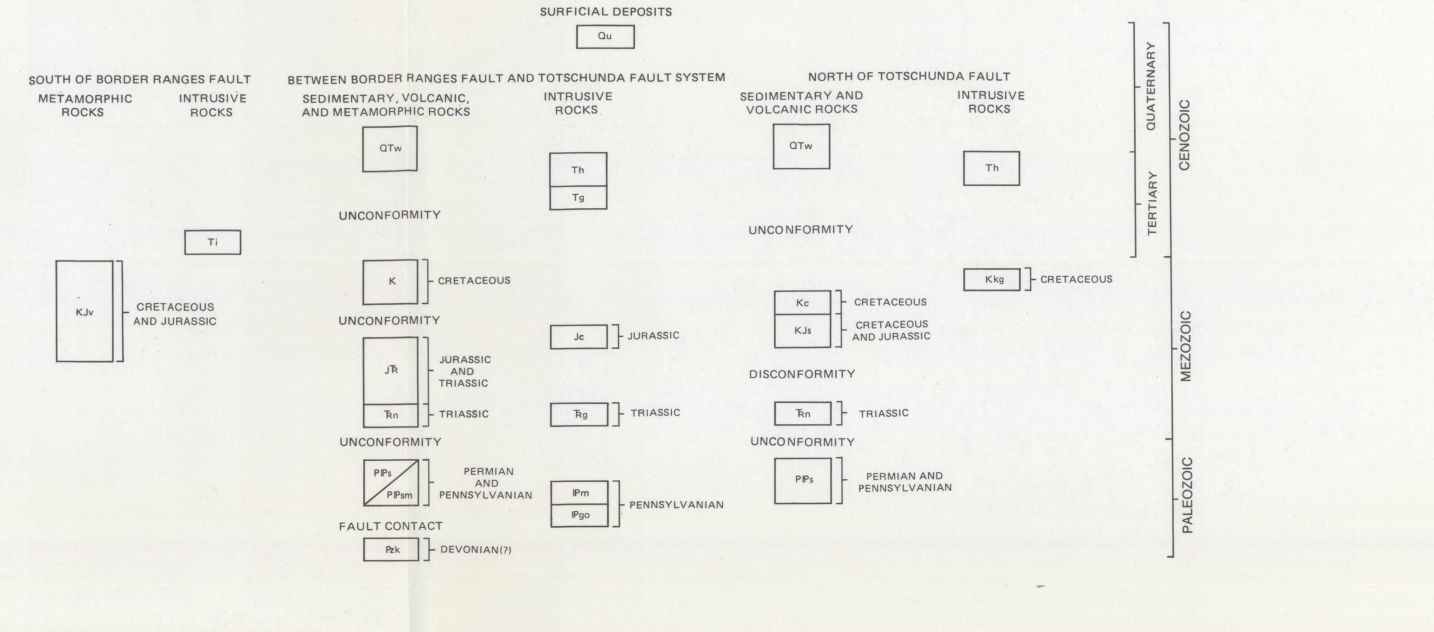
EXPLANATION FOR GENERALIZED GEOLOGIC MAP
(GEOLOGY GENERALIZED BY MacKEVETT, 1976)

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qu — UNCONSOLIDATED SEDIMENTARY DEPOSITS (Quaternary)

SOUTH OF BORDER RANGES FAULT

METAMORPHIC ROCKS

KJv — VALDEZ GROUP (Cretaceous and Jurassic?)

INTRUSIVE ROCKS

Ti — INTRUSIVE ROCKS (Eocene?) Typically, foliated granodiorite and tonalite

BETWEEN BORDER RANGES FAULT AND TOTSCHUNDA FAULT SYSTEM

SEDIMENTARY, VOLCANIC, AND METAMORPHIC ROCKS

QTw — WRANGELL LAVA (Quaternary and Tertiary) Chiefly subaerial andesitic lava flows and tephra; includes local subaerial sedimentary rocks of the Frederika Formation

K — MARINE SEDIMENTARY ROCKS (Upper and Lower Cretaceous) Includes MacColl Ridge, Chititu, Moonshine Creek, Schulze, and Kennicott Formations, and unnamed Lower Cretaceous rocks

JR — MARINE SEDIMENTARY ROCKS (Jurassic and Triassic) Includes Root Glacier, Nizina Mountain, Lubbe Creek, and McCarthy Formations, Kotsina Conglomerate, and Nizina and Chitistone Limestones

Rn — NIKOLAI GREENSTONE (Upper and (or) Middle Triassic) Mainly subaerial tholeiitic basalt; includes subordinate Chitistone Limestone north of Totschunda fault system

PPs — SKOLAI GROUP (Permian and Pennsylvanian) As mapped includes a few scattered remnants of Middle Triassic sedimentary rocks in northeastern part of quadrangle

PPsm — METAMORPHOSED SKOLAI GROUP (Permian and Pennsylvanian) Includes a few small outcrops of serpentinized ultramafic rocks near Border Ranges fault

Pzk — KASKAWULSH GROUP OF KINDLE (1953) (Devonian?)

INTRUSIVE ROCKS

Th — FELSIC HYPABYSSAL ROCKS (Pliocene) Mainly porphyritic dacite

Tg — GRANODIORITE (Pliocene) Unfoliated granodiorite with local mafic border facies

Jc — CHITINA VALLEY BATHOLITH (Jurassic) Mainly foliated quartz monzodiorite, granodiorite, and tonalite

Rg — GABBRO

Pm — MONZONITIC-GRANITIC COMPLEX (Pennsylvanian) Mainly nonfoliated quartz monzonite and granite, local mafic border facies

Pgo — GABBRO AND ORTHOGNEISS (Pennsylvanian)

NORTH OF TOTSCHUNDA FAULT SYSTEM

SEDIMENTARY AND VOLCANIC ROCKS

QTw — WRANGELL LAVA See above

Kc — CHISANA FORMATION (Lower Cretaceous) Marine and subaerial volcaniclastic and volcanic rocks

KJs — NUTZOTIN MOUNTAINS SEQUENCE (Lower Cretaceous and Upper Jurassic)

Rn — NIKOLAI GREENSTONE See above

PPs — SKOLAI GROUP See above

INTRUSIVE ROCKS

Th — FELSIC HYPABYSSAL ROCKS See above

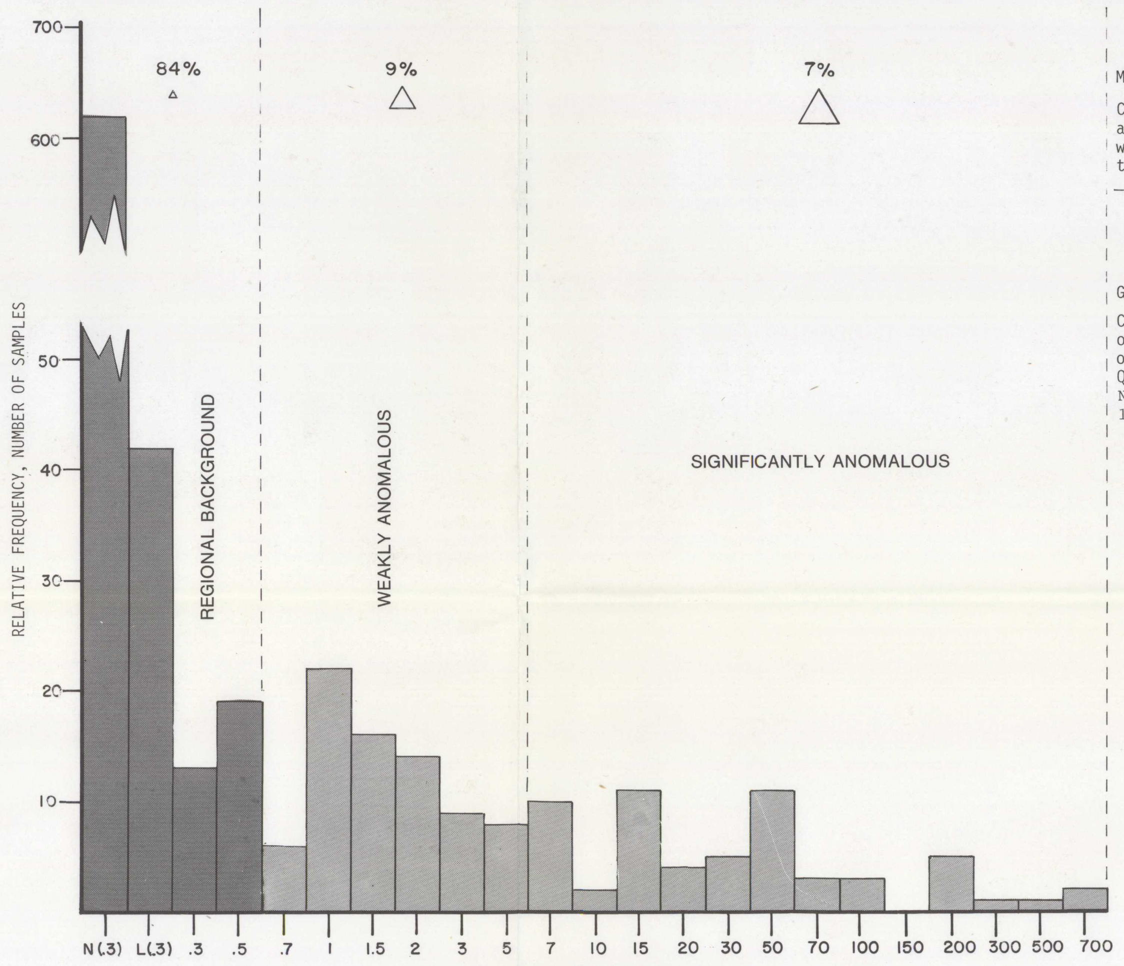
Kkg — KLEIN CREEK PLUTON (Cretaceous) Chiefly granodiorite

Contact; dotted where concealed

High-angle fault; dotted where concealed

Thrust fault; sawteeth on upper plate. Dotted where concealed

NOTE: Areas without letter symbols are glaciers and snowfields



Histogram showing frequency distribution, analytical range, and map symbols for silver in samples of bedrock, mineralized rock, veins and altered rock, McCarthy quadrangle, Alaska

MODE = N(.3) ppm
MEDIAN = N(.3) ppm

Calculation based on analysis of 827 samples with concentrations of Ag in the range N(.3) through 700 ppm

ARITHMETIC MEAN = 30 ppm
STANDARD DEVIATION = 94
GEOMETRIC MEAN = 3.6 ppm
GEOMETRIC DEVIATION = 6.8

Calculation based on analysis of 165 samples with concentrations of Ag in the range 0.3 through 700 ppm. Qualified N and L values not included. N, not detected; L, detected but below limit of determination (0.3).

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